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Update 1996/97

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IMPACTS OF LOGGING ON BOREAL BIRDS IN THE MIXEDWOOD FOREST

by

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DISCLAIMER

The study on which this report is based was funded by the Environmental Protection Enhancement Fund (EPEF). The views, statements and conclusions expressed and the recommendations made in this report are entirely those of the author and should not be construed as the statements or conclusions of or as expressing the opinions of the Manning Diversified Forest Products Integrated Technical Sub-Committee.

Abstract:

Barred owls were captured and radiotagged in old aspen mixedwood forest near Calling Lake in contiguous forest and forest fragmented by logging. Owls with territories next to and overlapping cutblocks suffered higher mortality by predation by Great-Horned owls. Home range size ranges from 110 to 870ha. Nests are located in old forest (>90 yr). In the winter and early spring of 1997, we have conducted playback censuses of breeding boreal owls in contiguous old forest, old forest next to young forest (<80 yr) and next to cutblocks and recent burns. Great-horned owls are ubiquitous. Barred owls are found mainly in contiguous old forest and old forest adjacent to cutblocks or young forest. None were found in old forest next to burns. Other species were not numerous enough to anslyse. We are beginning habitat analysis of owl territories using GIS, but this is not completed..

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Introduction:

With the development of new technologies in the pulp and paper industry, the extensive stands of trembling aspen (*Populus tremuloides*) and balsam poplar (*P. balsamifera*) of the boreal mixed-woods have become commercially valuable. Under the operating rules currently used in the province of Alberta, aspen-dominated stands will be harvested following a two- or three-pass system whereby long and narrow cutblocks will be created, with a projected rotation period of about 70 years (Alberta Energy/Forestry, Lands and Wildlife 1992). This will result in a rapid fragmentation of aspen-dominated stands, and a truncation of the current age distribution. Stands older than rotation age will only be found in riparian buffer strips along permanent watercourses, or as stands that are too small or isolated to be of commercial value (Schmiegelow and Hannon 1993).

Maintaining wildlife diversity should be an important goal of forestry, however, values for wildlife other than game species are rarely incorporated into harvesting strategies. A recent review of forest management in Alberta (Dancik et al. 1990) highlighted the dearth of knowledge about the impact of current harvesting strategies on wildlife, in particular on nongame species. The current operating ground rules will favour wildlife that benefits from the creation of edge and that does not need large areas of continuous forest. It will be very detrimental to species susceptible to negative edge effects (such as increased predation), those that require large undisturbed areas (area-sensitive species), and those that are dependent on old aspen forest. Some species of raptors (hawks, owls) may suffer in fragmented landscapes because of their large home range requirements. For example, Carey et al. (1992) found that northern spotted owls (Strix occidentalis caurina) living in fragmented landscapes had larger territories and lower foraging efficiency than those in continuous woodlands.

We began working on raptors in 1992, in conjunction with Gordon Court. This work indicated a change in the raptor community after logging. American Kestrels and Red-tailed Hawks became more abundant after logging and accipiters, Barred owls and Broad-winged hawks decreased after logging and were found mostly in old aspen and aspen-spruce mixed-wood. We do not know whether these changes also occur after fire. We have done some intensive work radio tracking adult Barred Owls to determine their home range sizes and responses to logging. To date, two females nesting beside cutblocks were depredated by Great Horned Owls during the late autumn, whereas radio-marked owls from territories in continuous forest are still alive. These observations are significant, as some workers have suggested that forest fragmentation favours colonization by Great Horned Owls and that competition and predation by this species will decrease Barred Owl numbers in managed forest (Laidig& Dobkin 1995).

Project Objectives

1. To monitor changes in the raptor community in continuous forest and in forest that has been fragmented by harvesting and fire.
2. To determine habitat associations of the major raptor species of the boreal forest.
3. To determine the impact of logging on a potentially sensitive species, the Barred Owl.
4. To use the results to help the forestry industry to plan logging designs so that they will minimize impacts on sensitive forest birds.

METHODS

Study area

Owl community surveys were conducted in four regions of north-central Alberta over nine townships (900 km^2). Calling Lake, North Wabasca Lake, Owl River and Goodwin Lake were chosen because they occur within the Alberta Pacific Forest Industries Inc. forest lease and are characteristic of the boreal mixedwood ecoregion (Strong and Leggat 1992). Calling Lake was fragmented by logging of aspen stands in 1994 and 1995. North Wabasca Lake has large unfragmented aspen stands.; regenerating conifer clearcuts are the only harvested areas. Aspen stands at Owl River were initially logged in 1993 and aAspen stands at Goodwin Lake were fragmented by forest fire in 1992. Radio-tracking of Barred Owls was done at Calling Lake.

Owl community surveys

Winter/spring surveys were conducted starting in Feb. and will continure until the end of April. The sample unit for the survey is a 6 km transect consisting of 3 owl calling stations at 2 km intervals. Sampling stations along each transect must be 2 km apart in order to ensure that owl responses from adjacent points represent different territories or different owls from the same territory (Bosakowski *et al.* 1987). Transects are separated by at least 5km in order to maintain independence between the sample units. Five km is a conservative estimate of the home range diameter of a Barred Owl based on radio-telemetry data from Calling Lake (Gordon Court unpublished data, Olsen unpublished data). Transects were located through an equal proportion of fragmented and contiguous forest. Each of the owl calling stations were surveyed once in the early breeding season (February - March) and once late in the breeding season (March and April) in order to sample the peak calling times for most owl species. Call surveys begin one hour after sunset on evenings when the temperature is above -25°C.

The procedure at each call station is as follows: (1) two minutes of pre-broadcast listening for unsolicited owl vocalizations, (2) eight minutes of broadcasting boreal owl (*Aegolius funereus*) calls, (3) two minutes of listening, (4) eight minutes of broadcasting Barred Owl calls, and (5) five minutes post-broadcast observation. Calls are broadcast in the four cardinal directions. The location of each owl response is determined by recording the direction of the call using a compass and estimating the distance within 1 km. We believe that a maximum sampling distance of 1 kilometer is a conservative estimate for our particular study area.

Methods for capturing and radio-tagging Barred Owls.

Once Barred Owl territories have been located during the call surveys, individual owls are captured using two techniques. For the first method, we enter an owl territory one hour after sunset and proceed to play a series of pre-recorded Barred Owl vocalizations. The tape begins with a single male calling for approximately 20 minutes, followed by a male and a female calling together. An aggressive response from the resident pair is easily solicited by playing the typical male/female duet which consists of 6 to 9 ascending hoots, followed by the hoo-aw call. Owls are trapped by placing a live Barred Owl decoy in the centre of three mist-nets that are arranged in a triangle around the decoy. Modified Swedish-Goshawk traps are designed to capture birds of prey using cowbirds, house sparrows or pigeons as bait (Kenward *et al.* 1983). Although this technique was successful for capturing other birds of prey, we captured only three Barred Owls using this technique (Gordon Court unpublished data, Olsen unpublished data).

Once a Barred Owl has been captured we band, radio-tag and measure the bird. A harness constructed of Teflon strapping holds the radio-transmitter on the back of the owl between the scapula (Gutterman *et al.* 1991) We measure wing chord (mm), foot pad (0.1 mm), body mass (g), tail length (mm) and primary molting pattern. Sex is determined by body mass (females larger than males) and by the presence of a brood patch (females).

Radio-telemetry surveillance to determine Barred Owl home range size, habitat use and mortality

Radio-tracking of Barred Owls is accomplished using two methods: triangulation and walking in on the birds. The triangulation method is useful for collecting accurate locations on several birds in one day. A triangulation requires a minimum of three compass bearings taken from different locations. Each compass bearing is estimated using the loudest signal method (Springer 1979). Compass bearings are plotted in the field on photocopies of 1:20000 aerial photographs. Walking in on owls is important for determining the accuracy of triangulations, finding day roosts, and locating nesting sites (Gutterman *et al.* 1991). Owls should be located periodically in order to record mortality events. Home range estimates will be calculated using the minimum convex polygon method. The number of radio-telemetry points will be plotted against the cumulative home range size of the owl in order to determine how many points are required for the home range estimate.

Habitat analysis of radio-telemetry locations and call survey points

Habitat data will be obtained by plotting radio-telemetry locations and call survey points on digital vegetation inventory maps and analyzed using Geographical Information Systems (GIS). GRASS GIS software will be used to analyze the habitat data. Habitat analysis will include both floristic and physiognomic parameters. Floristic variables include stand type (dominant tree species), year of origin (stand age), canopy closure (overstory density), and any factor related to the characteristics of the vegetational component of the forest. Physiognomic attributes will include the area and juxtaposition of stands or habitat patches. Some of these physiognomic variables are edge to area ratio, distance to water, proportion of non forested area (fragmentation index).

PRELIMINARY RESULTS AND DISCUSSION

Abundance of Barred Owls

In the breeding season of 1996, the density of Barred Owls was 0.04 pairs/km^2. The density of Barred owls in the Calling Lake study area is considerably lower than in other parts of its North American range where values of 0.147 pairs/km^2 (Smith 1978), 0.157 pairs/km^2 (Bosakowski *et al.* 1989) and 0.355 pairs/km2 (Elody 1983) have been reported. The density of Barred Owls at Calling Lake is similar to the density of this species in other regions of Alberta (Lisa Takats, unpublished data).

Relative abundance of owls in fragmented and contiguous forest

The difference in response rate of Barred Owls between fragmented and contiguous forest was not significantly different in 1994 to 1996 (Table 1). The 1997 winter owl survey has been expanded to include more harvested and unharvested areas, young forest (<80 yr) and old mixedwood habitat patches (>90 yr) adjacent to burns and clearcuts. Preliminary results from 1997 suggest the Barred Owls do not avoid old mixwedwood forest patches adjacent to predominately young forest during the early breeding period (February to March) (Fig. 1). Barred Owls were not located in patches of mixedwood and aspen forest that had been recently isolated by forest fire. Surveys during the late breeding season (March to April) may provide further insight of the distribution of Barred Owls during the nesting period of the breeding season.

In 1994 the response rate of Great Horned Owls was significantly higher in the contiguous forest than in the fragmented forest but was not significantly different in other years (Table 1). We encountered boreal owls, Northern saw-whet owls and Northern pygmy owls on the transects, but their numbers were too low for analysis.

Table 1. Proportion of responses in fragmented (n = 20, 1994-1996) and contiguous(n = 25, 1994-1995; n = 20, 1996) forest for two sympatric owl species. Significant diferences ($p<0.05$) were observed for the Great Horned Owl in 1994.

Year	Species	Response Rate		G-statistic (p-value)
		Contiguous	Fragmented	
1994	Barred Owl	28%	15%	1.12 (0.30)
	Great Horned Owl	16%	0%	5.01 (0.03)
1995	Barred Owl	16%	10%	0.32 (0.57)
	Great Horned Owl	8%	15%	0.55 (0.48)
1996	Barred Owl	25%	5%	3.38 (0.08)
	Great Horned Owl	15%	20%	0.17 (0.69)

Radio-telemetry of Barred Owls

Eleven Barred Owls have been captured and marked with radio-transmitter devices (Table 2). Three birds in fragmented forest have been killed by Great horned owlss, the remainder are still alive and being tracked.

Table 2. Record of radio collared Barred Owls in fragmented (n=6) and contiguous (n=5) forest at Calling Lake, Alberta. Date= capture date.

Owl[a]	Sex[b]	Territiory	Status	Date	Forest Type	Method[c]
BAOW #951	M	BOG ROAD	Active	14-4-95	Contiguous	MN
BAOW #942	F[b]	GROUSE ROAD	Predated	17-6-94	Fragmented	DL
BAOW #953	F	TOWER ROAD	Active	12-6-95	Contiguous	DL
BAOW #954	F[b]	GROUSE ROAD	Predated	20-4-95	Fragmented	HN
BAOW #965	F	QUINN CREEK	Active	10-2-96	Fragmented	HN
BAOW #966	M	WEST ROAD	Active	12-5-96	Contiguous	MN
BAOW #967	M	LONG LAKE	Active	16-5-96	Fragmented	MN
BAOW #968	F[b]	SOUTH CAMP	Predated	28-5-96	Fragmented	MN
BAOW #969	M	WOLF ROAD	Aotive	28-6-96	Fragmented	MN
BAOW #9610	M	TOWER ROAD	Active	3-7-96	Contiguous	MN
BAOW #9611	M	CALLING LAKE	Active	8-8-96	Contiguous	MN

[a] *Numerical code for each owl represents the year of capture (first two digits) followed by the chronological order of each subsequent capture.*

[b] *Breeding birds because a brood patch was present, or in the case of BAOW #954 the bird was captured on the nest.*

[c] *Capture method: Mist net (MN), Swedish Goshawk Droplid trap (DL), Hand net (HN)*

Eight Barred Owls were tracked in July and August, 1996. Home range size was determined using the minimum convex polygon (MCP) method. Annual Barred owl home ranges averaged 481.4 ha (sd=277.3, n=7). Home range sizes for the seven owls ranged from 110.8 ha to 871.6 ha.

In the winter of 1997 (January-April), I will continue radio-tracking two female (#953, #968) and four male (#967, #969, #9610, #9611) Barred Owls. During this period, one location per week will be obtained from each owl. It will be necessary to capture one owl from ten different territories in order to compare home range size and habitat use between owls in fragmented and contiguous forest. I intend focus my trapping efforts on five territories in fragmented forest and five territories in contiguous forest during the spring of 1997.

Barred Owl nesting records for Calling Lake, Alberta.

Four Barred Owl nests have been discovered near Calling Lake. All four nests were located in old growth forest stands, greater than 100 years old. Only one of these nests was active during the 1996 breeding season. The three unoccupied nesting sites had been recently fragmented by logging and subsequently failed to provide suitable nesting habitat for the resident owls. The one nest that was active in 1996 was located in the interior of and old growth mixedwood stand, greater than 200 m from the edge of the nearest clearcut. Considerable effort will be made to locate additional Barred Owl nesting sites. Information on the nesting habitat requirements of this species is essential for determining the degree of fragmentation that this species can with stand as logging of mature and old growth mixedwood forest proceeds in this region.

MANAGEMENT IMPLICATIONS

Forest raptors are often sensitive to forest fragmentation because of their large home range requirements. Sensitive species like the barred owl may disappear from forests if they become too fragmented. We will use our research to predict what changes will occur in the raptor community after traditional logging. In addition, by knowing the habitat and home range requirements of sensitive species of raptors we hope to be able to predict impacts of a variety of logging practices on these species. For example, for highly sensitive species, we may need to harvest the forest in larger blocks so that in the future there will be tracts of habitat large enough to support them. In some cases, if old forest is required, we may need to allow longer rotation periods on some blocks or we may need to incorporate a protected areas strategy for certain landscapes. In addition, we will determine how the owl community responds to landscapes fragmented by fire. Attempts by forest companies to incorporate ecosystem management into their forest planning often rest on an understanding of how wildife response to fire differs from response to logging. Society in general places a high premium on maintaining biodiversity in our forests. With proper planning we should be able to sustain biodiversity values. Species like raptors often serve as "umbrella species" for other species. If sufficient habitat is managed for forest raptors, then other sensitive species will be conserved as well.

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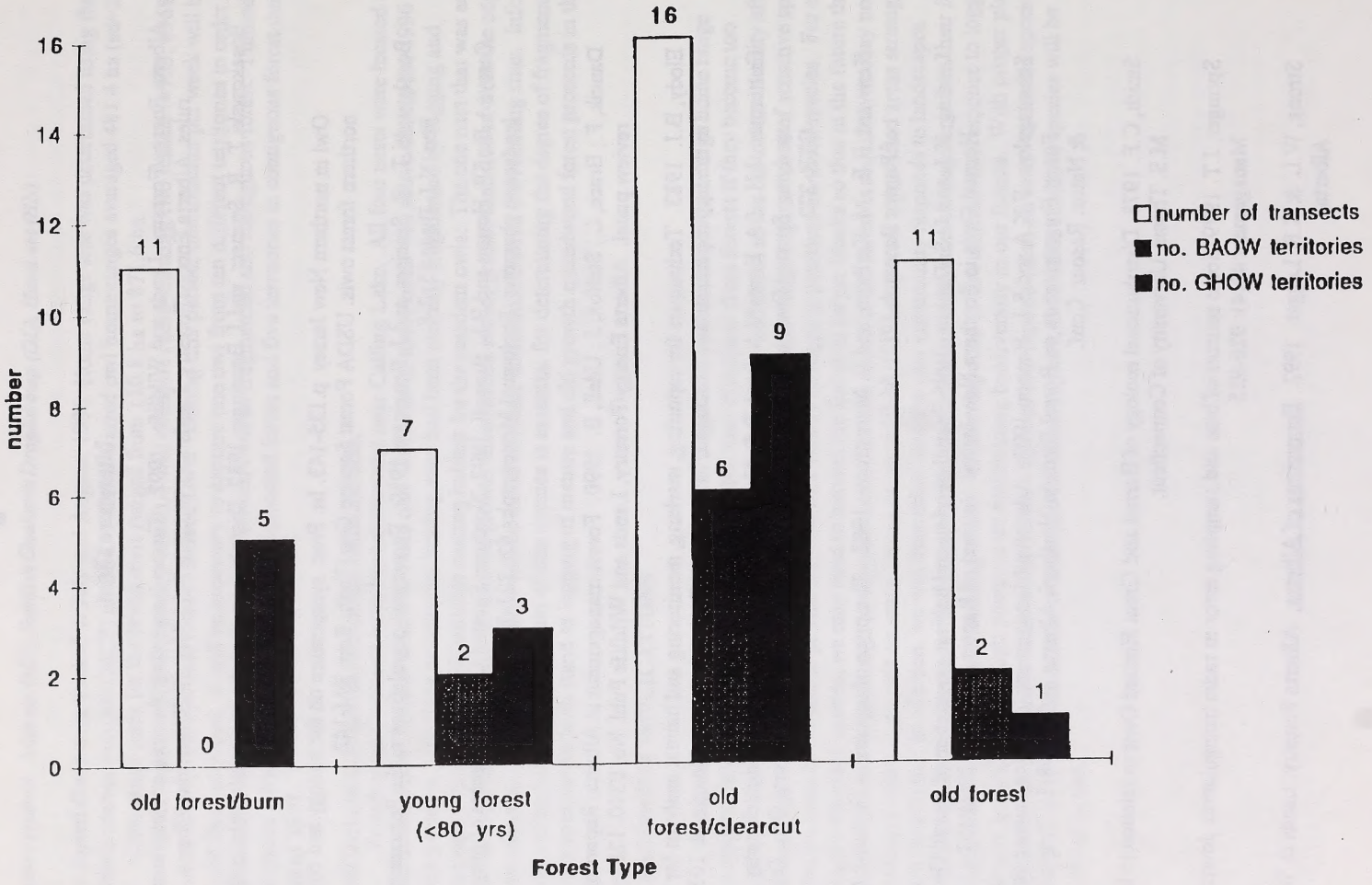

Fig. 1.